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MISSION OPERATIONS AND DATA SYSTEMS DIRECTORATE

Earth Observing System (EOS) Data and Information System (EOSDIS) Backbone Network (EBnet) Operations Concept Document

Revision 1

May 1996

National Aeronautics and Space Administration

Goddard Space Flight Center
Greenbelt, Maryland

Earth Observing System (EOS)
Data and Information System (EOSDIS)
Backbone Network (EBnet)
Operations Concept Document

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Preface

This document is under the configuration management of the National Aeronautics and Space Administration (NASA) Communications (Nascom) Division Configuration Control Board (CCB).

Proposed changes to this document shall be submitted to the Nascom CCB, along with supportive material justifying the proposed change. Changes to this document shall be made by document change notice (DCN) or by complete revision.

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Abstract

This document describes the operations concepts for the daily operation of the EOSDIS Backbone Network (EBnet), the daily activities in the EBnet Network Operations Center (NOC), and the roles and responsibilities of the EBnet operations staff.

Keywords: *EOSDIS Backbone Network, EBnet; Operations Concept, Network Management*

Change Information Page

List of Effective Pages			
Page Number	**Issue**	**Page Number**	**Issue**
Title	Revision 1	8-1	Revision 1
iii through ix	Revision 1	9-1 and 9-2	Revision 1
1-1 and 1-2	Revision 1	A-1	Revision 1
2-1	Revision 1	AB-1 and AB-2	Revision 1
3-1 through 3-3	Revision 1	DL-1	Revision 1
4-1 through 4-3	Revision 1		
5-1 through 5-3	Revision 1		
6-1 and 6-2	Revision 1		
7-1	Revision 1		

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Contents

Section 5: Interfaces with External Organizations

Section 6: NOC Workflow Process

Section 7: Maintenance Policy

Section 8: Sustaining Engineering

Section 9: Operational Scenarios

Figures

Appendix A. Troubleshooting Procedures

Abbreviations and Acronyms

Distribution List

Section 1. Introduction

1.1 Authority and Responsibility

The Mission Operations and Data Systems Directorate (MO&DSD) has the authority to implement Earth Observing System (EOS) Data and Information System (EOSDIS) Backbone Network (EBnet). This authority was granted to the MO&DSD by the EOS project, under the Office of Mission to Planet Earth (Code Y). The EBnet project is under the National Aeronautics and Space Administration (NASA) Communications (Nascom) Division of the MO&DSD.

1.2 Purpose

The purpose of this document is to describe the EBnet Network Operations Center (NOC), the operations concepts for the daily operation of the EBnet, the daily activities in the EBnet NOC, and the roles and responsibilities of the EBnet operations staff.

1.3 Scope

This document describes the hardware and software used in the EBnet NOC and how it will be used in the daily operation of EBnet.

1.4 Time Frame

This Operations Concept Document (OCD) shall be in effect from the date of the last approval signature.

1.5 Standards Precedence

EBnet and the EBnet NOC will be based on Government, commercial and international standards. In case of conflict, the following precedence (in descending order) applies:

- This EBnet Operations Concept Document
- Government standards
- Commercial and/or international standards

1.6 Document Organization

Section 2 contains parent, applicable and reference documents related to this OCD.

Section 3 contains a systems overview of EBnet and the EBnet NOC.

Section 4 contains a description of the EBnet staffing levels and the roles and responsibilities of the staff.

Section 5 contains a description of external organizations that interface with EBnet and the EBnet NOC.

Section 6 describes the EBnet NOC helpdesk workflow and trouble management procedures.

Section 7 contains a description of the maintenance policies and procedures.

Section 8 contains a description of the EBnet sustaining engineering function.

Section 9 details several operational scenarios to illustrate the workflow concepts.

Section 10 details several basic troubleshooting procedures to illustrate the types of problems and actions required for resolution.

A list of abbreviations and acronyms is provided at the end of this document.

Section 2. Related Documentation

2.1 Parent Documents

[1] *Earth Observing System Detailed Mission Requirements*, Interim Draft Release, July 1995

[2] *Earth Science Data Information Systems (ESDIS) Project Level 2 Requirements Volume X Earth Observing System (EOS) Data and Information System (EOSDIS) Backbone Network (EBnet) Requirements,* December 1995

[3] *Earth Observing System (EOS) Data and Information System (EOSDIS) Backbone Network (EBnet) Interface Requirements Document (IRD),* September 1995

2.2 Applicable Documents

[4] *Internet Protocol (IP): DARPA Internet Program Protocol Specification,* Request for Comment (RFC) 791, September 1981

[5] *Internet Control Message Protocol,* RFC 792, September 1981

[6] *A Simple Network Management Protocol,* RFC 1157, May 1990

[7] *Management Information Base Network Management of TCP/IP Based Internets: MIB-II*, RFC 1158, May 1990

[8] *Earth Observing System (EOS) Data and Information System (EOSDIS) Backbone Network (EBnet) Training Plan*, 540-018, Draft, May 1996

2.3 Reference Documents

[9] *Communications Requirements for ECS Project,* 220-CD-001-003, GSFC, February 1995

[10] *NASA Communications (Nascom) Access Protection Policy and Guidelines, 541-107, Revision 2,* GSFC, August 1995

[11] *NASA Communications System Acquisition and Management,* NASA Management Instruction (NMI) 2520.1D, NASA, November 18, 1991

[12] *MODNET/NOLAN Users Guide*, 541-225, May 1995

[13] *NASA Communications Operating Procedures (NASCOP), 542-006, Volume 2, July 1990, and Volume 3, January 1989.*

Section 3. Systems Overview

3.1 EBnet General System Description

The EBnet provides wide-area communications circuits and facilities between and among various EOS Ground System (EGS) elements to support mission operations and to transport mission data between EOSDIS elements. EBnet is responsible for transporting spacecraft command, control and science data nationwide on a continuous basis, 24 hours per day, 7 days per week. The EBnet capability to transport these diverse types of data is implemented as two distinct subnetworks referred to as "real-time" and "science" networks. The real-time network transports mission critical data related to the health and safety of on-orbit space systems and raw science telemetry as well as pre-launch testing and launch support. This highly redundant network provides an operational availability of 0.9998 with a Mean Time to Restore Service (MTTRS) of 1 minute. The science network transports data collected from spacecraft instruments and various levels of processed science data including expedited data sets, production data sets and rate-buffered science data. The science network provides an operational availability of 0.98 with a MTTRS of 4 hours.

The EBnet is monitored 24 hours per day, 7 days per week from the network management station located in the NOC. This document describes the NOC, the network management system and the roles and responsibilities of the persons who perform the monitoring, operations and maintenance of the EBnet. The required availability for the NOC is 0.96 with four hours MTTRS.

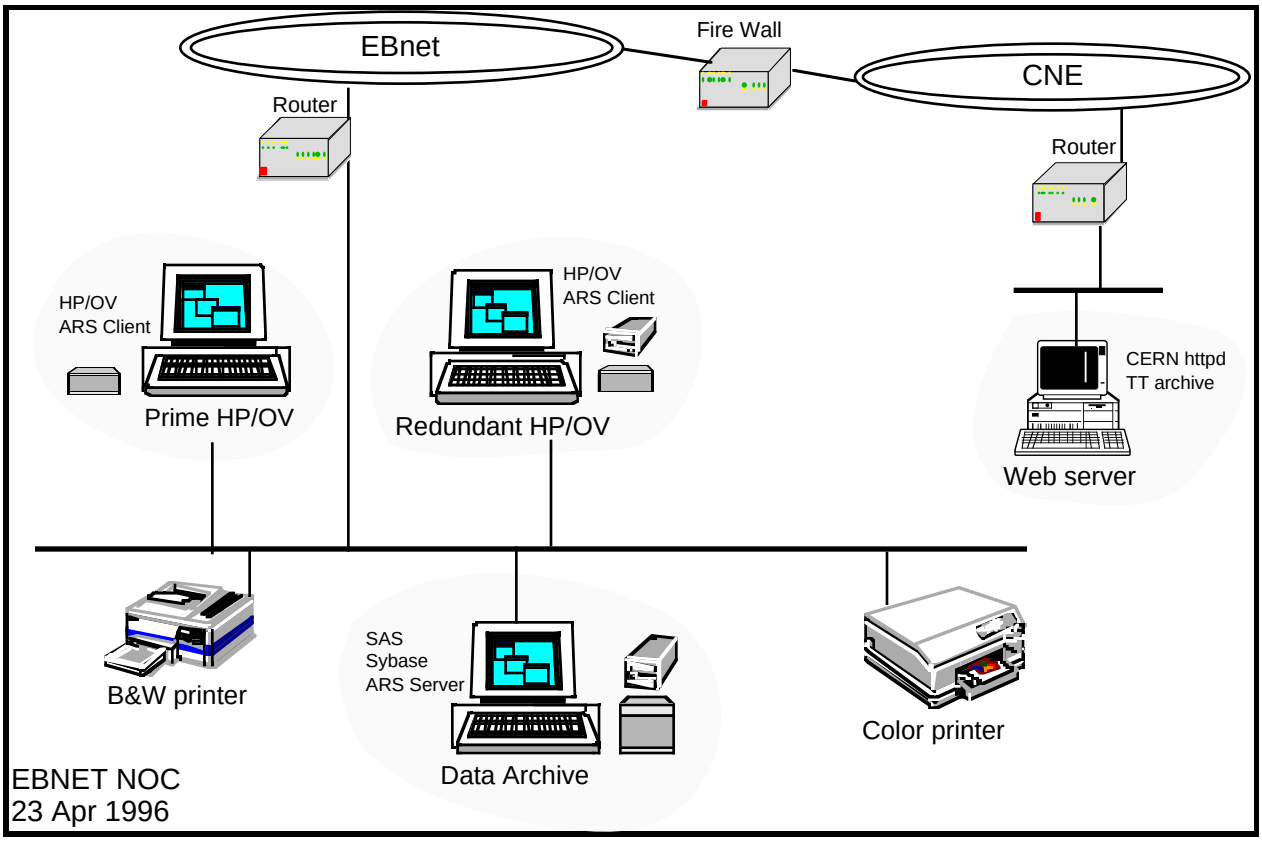

Figure 3-1 NOC Layout

3.2 NOC System Overview

The purpose of the EBnet NOC is to provide monitoring, management and data collection function for all components of the EBnet, to provide a proactive approach to operating a network by providing advance warning of potential problems, to provide rapid notification when a problem occurs, to provide an organized approach to managing problem reports from the user community and to provide a highly effective level of service and support to the EBnet customers.

The core monitoring capability for the EBnet NOC will be provided by a set of Sun Sparcstation 20 workstations running a suite of Commercial Off-the-Shelf (COTS) software products. The HPOpenView Simple Network Management Protocol (SNMP)-based Network Node Manager product will provide the capability to monitor operational data and status from network infrastructure equipment (routers, switches, hubs, concentrators, etc.) The Remedy Action Request System will provide a trouble-ticketing capability for management of trouble reports, enforcing the procedures for flow of fault and status data through the organization and enforcing problem escalation rules to ensure meeting the MTTRS requirements. Data collected by HPOpenView (HPOV) and Remedy will be archived to the Statistical Analysis System (SAS) and processed on a routine basis to provide reports on usage, failure and operational trends. These software products are supported by integration with the Sybase Relational Database Management System. Trouble tickets and subsequent status updates will be made available to

the EBnet user community via a World Wide Web server and also by Simple Mail Transfer Protocol (SMTP) based electronic mail where applicable.

3.3 Physical Description of the NOC

There will be four workstations located in the NOC which will be the focal point for monitoring and troubleshooting in the NOC. Referenced by the acronyms as used in Fig. 3-1, WS1 will be the primary HPOV system and will drive an X-terminal which will project the top level HPOV map to the overhead projector. The lead operator will sit at WS1 and can display HPOV, Remedy or any other application on its monitor as necessary to perform required tasks. WS2 is the backup HPOV system, and the backup operator will sit at this console. WS2 will drive an X-terminal which will project the Remedy Open Tickets screen on the other overhead project. The Open Tickets screen will be automatically updated every five minutes by the Remedy notifier process. Again, the operator may display HPOV, Remedy or any other application on the monitor as necessary to perform required tasks. WS3 hosts the Statistical Analysis System (SAS), Sybase and Remedy engines and may be used by the Network Manager. WS1, WS2 and WS3 are connected to the network on the closed side of the Nascom Operational Local Area Network (NOLAN) (inside the secure firewall). WS4 is the World Wide Web (WWW) server used to distribute information to the Earth Observing System (EOS) community, and may also be used as a station to perform troubleshooting. WS4 is connected to the network on the open side of NOLAN (outside the secure firewall). There are two printers in the NOC as well as a fax machine. Manuals, policy documents, tapes and other reference materials are located in the bookcases on the left side of the room.

3.4 Staffing of the NOC

During the first shift, defined as 8:00 am - 4:00 p.m., the NOC will be staffed by two operators and the Network Manager. During the second shift (defined as 4:00 p.m. - 12:00 am) and the third shift (12:00 am - 8:00 am), the NOC is only staffed by two operators, but the Network Manager is on-call via pager.

Technicians will be onsite at GSFC on a 24 by 7 basis. There will be one technician available for each of the three shifts.

Technicians at remote sites are only present during the first shift. These are actually Distributed Active Archive Center (DAAC) personnel or other local campus networking personnel. All other maintenance will be supplied via maintenance contracts with vendors on an on-call basis, during hours in which the vendor personnel have access to the facility.

Section 4. Roles and Responsibilities of EBnet Personnel

4.1 Communications Manager (COMMGR)

The Nascom COMMGR has overall responsibility for coordination between all elements of Nascom. The COMMGR has a global view of the interaction between the Nascom IP network, the 4800-bit block network and voice network. The COMMGR is the focal point for Nascom users to report problems and is the official point of contact for Nascom operational status information. The COMMGR coordinates problem reports between the relevant elements of Nascom to get the problem resolved. Nascom employees working in various elements of Nascom are responsible to keep the COMMGR informed of status and progress. The COMMGR will be provided with access to HPOV and Remedy and thus will have an up-to-date view into the network and the problems/troubleshooting in progress.

At least in the early phases of EBnet operations, the COMMGR can be expected to play the same role for EBnet as with the rest of Nascom. Users experiencing problems should report the problems to their organization's NOC or support staff. Peer NOCs from other organizations upon identification of problems related to EBnet may either contact the COMMGR to report the problem or report the problem to the EBnet NOC directly.

4.2 Network Manager

The Network Manager is responsible for the daily operation of the NOC and the EBnet network: for the technical issues, troubleshooting, vendor interaction, and ensuring that all policies and procedures are met/followed by the operators. The Network Manager should know everything that an operator knows plus possess an understanding of the complete picture of how the NOC systems are configured and interact, the topology and configuration of the IP network and understand IP sufficiently to perform debugging of IP and IP routing problems. The Network Manager will have successfully completed the "General" and "Operator" portions of the NASA Communications (Nascom) training program described in the *EBnet Training Plan* and have a full understanding of all concepts, technologies and procedures described therein.

The Network Manager interacts with the NOC systems as a "turn-key" system, a user of the system but not a developer. The Network Manager is provided a predefined environment in his user account, can display HPOV maps, poll MIB variables from devices, print real-time reports, and create, search and close trouble tickets. The Network Manager monitors all open trouble tickets and receives escalation notices from Remedy about aging trouble tickets, and has the authority to escalate problems to technicians or engineers.

4.3 Operators

The Operators are the focal point of the workings of the NOC. All operators will successfully complete the "General" and "Operator" portions of the EBnet training program as outlined in the *EBnet Training Plan*. Operators are responsible for understanding the complete picture of how the NOC systems are configured and how the software operates and interacts, the topology and configuration of the IP network and be able to perform IP and IP routing troubleshooting. Operators must be able to use network debugging tools like "traceroute", "netstat" and "ping" and interpret the results, visualize what the routing architecture looks like and how traffic should flow and understand the basics of router configuration (access lists, etc.). Operators are responsible for using Remedy and HPOV. Operators are responsible for receiving a basic set of reports and interpreting the data sufficiently to identify basic problems or potential problems. Operators will be expected to fix most basic and mid-level problems that occur in the network--- to the extent of identifying and isolating faults, determining the cause (failed component, failed circuit) and executing procedures for contacting circuit provider and ensuring the service is restored in the required time or executing the procedures for equipment repair/replacement. The operator is responsible for monitoring the status of all open tickets. The operator is responsible for routinely checking the network maps, traffic and performance reports, email, voicemail and the Remedy open tickets.

Operators will open new trouble tickets when problems are reported to the NOC, commonly via phone, email or automatic ingest of a trouble ticket from another EOSDIS domain, e.g. LSMs. Operators will be responsible for evaluating the reported problem (ascertaining if it is indeed an EBnet problem), making an assessment of the EOSDIS domains affected by the problem and ensuring that the appropriate notification selections are made on the trouble ticket forms so that the affected EOSDIS domains are notified of the problem and the subsequent status.

Operators, while needing to use and understand the applications that comprise the EBnet NOC system, have no development interaction with the systems. If additional data collection is required, the operator should contact the sustaining engineering staff to make the necessary modifications. An operator is provided with a fixed, predefined environment in his user account, and can display HPOV maps, poll Management Information Base (MIB) variables, print real-time reports and create, search and close Remedy trouble tickets. The operator can also print trouble tickets and trouble ticket summary reports.

Ultimately, the operator is expected to be the primary interface to users of the IP network for problem reporting and resolution.

4.4 Technicians at GSFC

Technicians at GSFC will support hardware and cabling changes and will be capable of performing firmware upgrades to equipment, replacing defective processor boards, be familiar with all relevant types of connectors, and be knowledgeable about putting devices in loopback mode and evaluating the results. All technicians will successfully complete the "General" and "Technician" portions of the EBnet training program as detailed in the *EBnet Training Plan*.. Technicians will be contacted by the operators and involved when the problem is isolated to a hardware problem.

Technicians will have a remote terminal with a Remedy client, and relevant trouble tickets will be routed automatically. Technicians should be constantly monitoring the Remedy client. A technician will be able to read and change diary fields in trouble tickets that are assigned to him/her and will have search access to all trouble tickets. A technician cannot create or close a trouble ticket, has no access to HPOV and has no login account on the NOC systems.

Section 5. Interfaces with External Organizations

5.1 Carriers

Operations staff will interface with the carriers (AT&T, PSCN) when the cause of a network fault is determined to be a component within the responsibility of the carrier, commonly a circuit failure. The operations staff will report the failure and maintain contact with the carrier to ensure that the problem is resolved in the contractually dictated timeframe and the ticket closed, otherwise the operations staff is responsible for escalating the problem to the Network Manager.

5.2 Sustaining Engineers

The sustaining engineers are responsible for troubleshooting problems that go beyond the capabilities of the operators, ongoing development of the EBnet and the network management system and for the infusion of new technology into EBnet. Only the Network Manager can involve the engineers in the investigation of a problem. Engineers are onsite 8x5, and on-call after hours. A more detailed description of the sustaining engineering function is provided in Section 8 of this document.

5.3 Remote Technicians

There will be staff at each EBnet site, but the details of the staffing level and affiliation are not resolved yet. The purpose of the remote site staff will be to perform hands-on activities like replacing failed interface cards or firmware upgrades, manually switching interfaces or equipment to loopback mode and powercycling or physically rebooting a piece of equipment which is nonresponsive to remote attempts for connection. These individuals will not likely be on the EBnet staff, but more likely will work in a DAAC, for the local campus networking organization, for another on-site network service provider or for an equipment vendor supplying maintenance. Remote technicians will have access to a remote terminal with a Remedy client, and will receive relevant trouble tickets automatically through Remedy. Remote technicians should routinely monitor the Remedy client for new problem reports.

5.4 Management Reporting

Reports as specified or requested will be provided to upper management on a routine basis. Management will be informed of problem situations requiring escalation beyond the normal channels. Reports currently generated include traffic (bytes per day per circuit per direction) and utilization (per circuit per direction).

5.5 COMMGR

The NOC Operators will interface with the COMMGR to keep the COMMGR informed of all network problems and provide the COMMGR with continuous status updates.

5.6 General Users

The operation centers for other elements of the EOSDIS project will access information about the status of EBnet via a WWW browser. The EBnet WWW server will be updated routinely with relevant trouble tickets and prearranged reports. No users will have accounts on any NOC systems nor access to any NOC application.

End users are ideally expected to report problems to their local helpdesk. DAAC LSMs, the SMC and helpdesks or NOCs for other EOS elements would then report EBnet problems to the EBnet NOC helpdesk via phone or by forwarding a trouble ticket from their domain to EBnet using the common Remedy transfer schema devised by the EOSDIS Enterprise Management Concept Team. Trouble tickets are exchanged between domains using Remedy's automated email exchange feature.

Initially, based on historical operations procedures, it is expected that many users will report problems to the COMMGR via voice loop or telephone, who will flow the information into the EBnet NOC.

5.7 DAAC Manager

The NOC will receive trouble reports and inquiries from the DAAC and DAAC manager, in the form of email, trouble tickets and phone calls, as detailed in the EOS Enterprise Management Concept (EMC) Team agreement on inter-domain exchange of fault information.

5.8 SMC

The NOC will receive trouble reports and inquiries from the SMC via email, trouble tickets and phone as detailed in the EOS EMC Team agreement on inter-domain exchange of fault information. The NOC will submit performance status reports as detailed in the EBnet-SMC ICD to the SMC.

5.9 EDOS

The NOC will receive trouble reports and inquiries from EDOS in the form of email and phone calls as per the EOS EMC Team agreement on inter-domain exchange of fault information.

5.10 Nascom

The NOC will interface with other elements of Nascom as required, primarily through the COMMGR.

5.11 Service Level Agreements (SLA) with Vendors

The NOC will contact vendors with whom EBnet has service level agreements for equipment repair and replacement as it is necessary to do so. When the NOC opens a call with a vendor, the operator will follow the call via Remedy updates until the equipment is replaced or repaired satisfactorily and in compliance with the vendor's contract with EBnet.

Section 6. NOC Workflow Process

6.1 NOC Workflow Process

The HPOpenView map will be displayed on the wall in the NOC at all times. A variety of events may occur in the network that would cause the HPOpenView system to generate a visual warning. If an interface (or link) goes down, the corresponding symbol in the map will change color from green to yellow within 5 minutes for components servicing science requirements, and within one minute for components servicing real-time requirements. If all interfaces of a node become unavailable, the map object will turn red. Pop-up windows will appear for all events such as link down, node down and thresholds exceeded. Operators will be alert to the information on the HPOpenView map at all times.

When an event occurs, the operator makes a rapid assessment of the impact. If the component services real-time traffic, the operator embarks immediately on isolating the problem and escalates it via a phone call to the technician if resolution requires technician involvement. Time is of the essence in this situation (driven by the MTTRS requirement for real-time service) and all non-real-time functions like opening a trouble ticket, notifying external organizations and generating email are delayed until after the problem is resolved or has passed from the operators responsibility. When a fault occurs disrupting service in the real-time network, the network is configured to automatically fail over to the redundant link. The urgency to restore the primary service in this case is because while the primary service is down, the real-time service is running without backup capability (should another fault occur). For network events involving components related to science data, the operator makes a quick assessment of the problem, opens a trouble ticket, and continues troubleshooting. If necessary, the operator will assign the trouble ticket electronically to a technician via Remedy. The technicians are required to begin responding to new tickets within five minutes. Technicians open the ticket in Remedy, assess the problem and work through to a solution. Upon problem resolution, the technician uses Remedy to fill in the pertinent fields, and returns the trouble ticket to the operator using Remedy routing. The technicians are responsible for performing replacements of line replaceable units (LRU) of network components from the stock of spare components whenever possible. All trouble tickets flow through the operators at all stages so that the operators are always informed about the network and problem status. The operator will review the ticket, verify that the service is restored and update the status to closed if appropriate. Only operators can close trouble tickets. Tickets not closed within two hours and any nonrealtime service not restored within four hours are automatically routed to the network manager. If technicians are unable to isolate or resolve the network problem, they may return the ticket to the operator who will escalate it to the network manager. The network manager has the option to subsequently route the ticket to the sustaining engineering team. The network manager is the only party who may involve the engineering team, who are generally not available for the day-to-day operational activities of the network.

Whenever a trouble ticket is opened, a copy will be posted on the NOC WWW page. At the operator's discretion, if the operator deems that a particular event impacts service to some

component of EOSDIS, the operator will automatically route a copy of that trouble ticket (and all subsequent updates) to the affected EOSDIS domains to notify them that there is a problem and it is being worked. Any status changes to that ticket will be posted to the WWW and also routed to any external parties who received the original.

Operators may receive the original notification of a problem from a variety of sources, including an HPOpenView event, a phone call from another organization, an email message from another organization, a call from the COMMGR or a Remedy trouble ticket automatically submitted from another domain. Upon determination that the reported event is indeed an EBnet problem, the problem report will be ingested into the EBnet Remedy system as an EBnet trouble ticket. External domains will be able to track the status of their original ticket because the external domain's trouble ticket number will be noted in the EBnet trouble ticket. If the problem is determined to not be an EBnet problem, the sender will be notified in the same manner the contact was originated: by a returned phone call, a returned email message or a rejected trouble ticket. Figure 6-1 graphically depicts the flow of information through the EBnet NOC.

At each shift change, the outgoing shift lead operator will debrief the incoming shift about the status of the network, including details of all open trouble tickets and all problems being worked. Each member of the outgoing shift should log out of the NOC workstations upon departure. Each member of the incoming shift should log in to the appropriate NOC workstation, restart the Remedy and HPOpenView processes, review details of all open trouble tickets (available from a pop-up window) and (based on which shift) change tapes in the tape drive for backups, if required. All workstations will be backed up once per day. All data from HPOV will be copied into a staging area every eight hours and subsequently ingested into SAS.

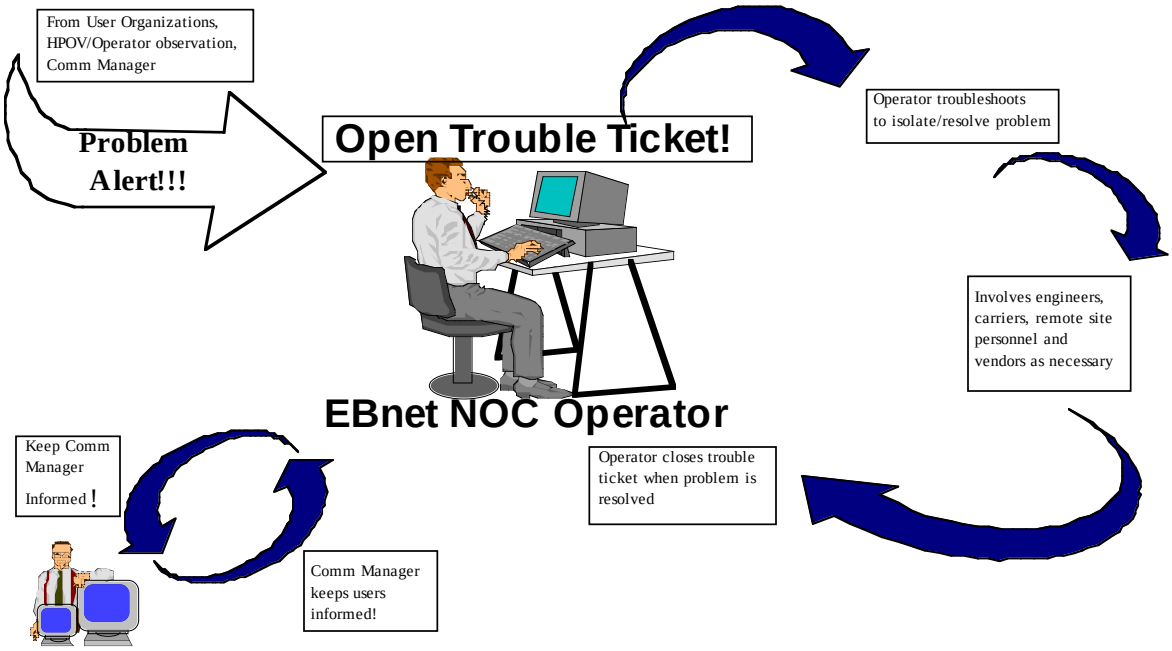

Figure 6-1 Workflow Flowchart

Section 7. Maintenance Policy

7.1 Hardware Maintenance

EBnet will contract with the vendors of the network components to provide hardware maintenance for the network equipment. These service level agreements (SLA) will be in existence with Cisco and 3Com (router maintenance), Sun Microsystems (NOC systems), Timeplex (multiplexers) and Cabletron (hubs). The contracted response time may differ from site to site, and the information required to log a maintenance call will also differ from vendor to vendor.

7.2 Equipment Sparing Policy

There will be some level of sparing for equipment at each site. The level of sparing will not necessarily be 100%, but will be based on the amount of equipment located at the site and statistical data on probability of equipment failure. EBnet staff at each site will perform LRU replacement of failed components with spare components. The failed components, once removed from the operational environment, will be returned to the vendor for repair in accordance with that vendor's SLA. Vendor maintenance and support is a non-real-time function. Failed components will be replaced with spares in order to restore the network to operation as quickly as possible.

7.3 Circuit Failure

When a circuit failure is detected, the circuit provider will be notified immediately. The procedure for contacting the provider and the information required to open a call is documented in the NASA Communications Operating Procedures. The carrier is contractually obligated to respond within 20 minutes. Real-time circuits are backed up by fully redundant circuits and should automatically fail over to enable EBnet to meet the MTTRS requirement.

7.4 Scheduled Maintenance

On occasion it will be necessary to schedule maintenance of some portion of the network which would cause the network to be unavailable for some period of time. Such scheduled outages will be minimized, but when necessary will be advertised to the EOS community via the EBnet WWW page and by issuance of an EBnet "Planned Outage" trouble ticket initiated from the EBnet Remedy system and disseminated to all elements of EOS as detailed in the EMC Team agreement on inter-domain exchange of fault information.

Section 8. Sustaining Engineering

8.1 The Goal of the Sustaining Engineering Function

The sustaining engineering facility will be staffed by a wide variety of individuals, most of whom work on EBnet only for a portion of the time. Due to the widely varied nature of the equipment and systems that comprise EBnet and the wide range of problems that might occur in the course of operation, it is not possible to identify just one or two individuals who embody all of that knowledge. Over time, some of the tasks required of sustaining engineers would include Unix system administration, COTS integration, network troubleshooting, TCP/IP performance analysis, router configuration, engineering of new connections and testbedding of new technologies, subsequently infusing that technology into the operational network.

8.2 Role in the Daily Operation of the Network

The sustaining engineers are responsible for troubleshooting problems that go beyond the capabilities of the operators. Engineers are not expected to be involved in simple circuit failures or equipment hardware failures, but would be expected to be involved in debugging gradual or sporadic service degradation problems or network misbehavior due to microcode or router operating system bugs. Engineers are responsible for sustaining engineering and development of the NOC and the network, including equipment testing and evaluation, developing router configurations, designing and enhancing the IP routing architecture and designing cable layout. Engineers should be Unix or IP experts (depending on what they are assigned to support). Only the Network Manager can involve the engineers in the investigation of a problem. Engineers are onsite 8x5, and on-call after hours.

An engineer can read and change diary fields in Remedy trouble tickets that are assigned to him/her, as well as changing Remedy screens and menus. An engineer can also view and change HPOV maps. Engineers will be responsible for all changes and customizations to the configuration of the applications that comprise the NOC and to the user account environment of the operators and network manager. An engineer can run and write SAS reports. Engineers are the only people with direct access to Sybase. Engineers are responsible for maintenance of the Unix automatic scheduling program and related configuration files that move data from HPOV to SAS and generate SAS reports. Engineers are responsible for all other system administration duties on the NOC systems. All changes will be subject to any configuration control procedure and policy set forth by the EBnet project.

Section 9. Operational Scenarios

9.1 Operator Identifies a Problem

The operator detects failure of a network device serving the science network by combination of network monitoring and alarm correlation. The operator then opens a trouble ticket to document the problem and ensure timely correction of the problem. The restoral countdown is started depending on the allocated MTTRS. Operator assigns trouble ticket to a technician.

The technician is notified of receipt of a trouble ticket and changes the status from new to open. The technician determines what caused the failure of the device in question. The technician restores service. They then update the diagnostic, resolution and restoral diaries on the trouble ticket. They also mark the trouble ticket as resolved and restored. Upon service restoral, they forward the trouble ticket back to the operator.

The operator is notified of receipt of a trouble ticket. After reading the diaries and rechecking the network monitor the operator determines the device is indeed back on-line and traffic is flowing. The operator then closes the trouble ticket.

If the technician does not change the status of the ticket from new to open with five minutes the operator will be notified.

9.2 User Reports a Problem to the EBnet NOC

A user calls the EBnet NOC because of unsatisfactory network performance or being unable to connect to a host on the WAN. (Note that a call from a user is only one of many ways that the NOC may be notified of a potential problem. Other notification may come from the COMMGR, an HPOpenView event, an email message or a trouble ticket submitted from another EOS domain). If the user is reporting a new problem, the operator records the user's contact information and symptoms noticed by user on a trouble ticket. The operator, using the network monitor and alarm correlation, then determines what is causing the failure or that the failure is not with the network. The operator then forwards the trouble ticket to the technician responsible for the failed device, or informs the user that the problem is not with the network.

If the user is reporting a known problem the operator informs the user that the problem is being worked and does not open a second trouble ticket.

The technician is notified of receipt of a trouble ticket and changes the status from new to open. The technician then diagnose the problem, and determines a resolution and restoral procedure for the problem. They update the diagnostic, resolution and restoral diaries on the trouble ticket. They also mark the trouble ticket as resolved and restored. Lastly they forward the trouble ticket back to the operator.

The operator is notified of receipt of a trouble ticket. After reading the diaries and rechecking the network monitor the operator determines the device is indeed back on-line and traffic is flowing. The operator then informs the user who called, if needed, and closes the trouble ticket.

9.3 Technician Unable to Restore Service

The technician was unable to diagnose the problem. They update the diagnostic diary and forward the trouble ticket back to a operator.

The operator is notified of receipt of a trouble ticket. Since the ticket has not been resolved or restored the ticket is forwarded to the manager for escalation. After reading the symptom and diagnostic diaries, the manager then performs more diagnostics and if needed forwards problem to an engineer. It should be assumed if problem has been forwarded that time to restore is now critical.

The engineer performs further diagnostics and involves the carrier or appropriate vendor maintenance personnel if the problem cannot be resolved internally. When the problem is resolved, the diagnostic, resolution, and restoral diaries are updated and the trouble ticket is marked resolved and restored. The trouble ticket is then forward back to the operators.

The operator is notified of receipt of a trouble ticket. After reading the diaries and rechecking the network monitor the operator determines the device is indeed back on-line and traffic is flowing. The operator closes the trouble ticket.

9.4 Trouble Ticket Not Resolved in a Timely Manner

The manager is notified if a trouble ticket has not been resolved in 2 hours. This can potentially be an indicator of a workflow management problem. The manager will contact the person assigned the trouble ticket to determine what action should be taken.

9.5 Service is Not Restored in a Timely Manner

The manager is notified if a service described in a trouble ticket has not been restored in 4 hours. The manager can then contact the person assigned the trouble ticket to determine what action should be taken. It is possible that carrier or vendor response and repair times have been exceeded by this time, and it may be necessary to elevate the problem to Nascom management.

Appendix A. Troubleshooting Procedures

A.1 Fault Isolation and Determination

[Assumption: DSUs are owned by EBnet and are SNMP manageable]

1. A network service problem is reported to the NOC operator.
2. The NOC operator makes a quick assessment of whether or not there is indeed a problem
3. The operator detects that a remote WAN edge device is not reachable via HPOV or otherwise, and the operator opens a trouble ticket
4. If this path supports real-time traffic, operator ensures that service has been restored within the MTTRS constraint automatically.
5. The operator performs out-of-band access to the device.
6. If device is accessible and functioning via out-of-band access mechanism, the operator performs remote loopback test between the two DSUs.
7. If the problem is with the carrier, continue with procedure in Section 10.2. Otherwise, continue with procedure in Section 10.3,

A.2 Carrier Failure

[Assumption: DSUs are owned by EBnet and are SNMP manageable]

1. Operator determines that problem is with carrier
2. Operator contacts carrier, reports the problem and receives a trouble ticket number from the carrier
3. Operator follows up with carrier and verifies service restoral when carrier reports success
4. Operator closes EBnet trouble ticket upon verification of service restoral

A.3 Local or Remote Device Failure

[Assumption: All devices are SNMP manageable]

1. Operator routes trouble ticket to relevant technician via Remedy
2. Technician resolves problem, involves vendor maintenance agreement if necessary
3. Technician fills in trouble ticket and returns ticket to Operator (possibly with a phone call as well)
4. Operator receives ticket, verifies service restoral, and closes ticket

Abbreviations and Acronyms.

CCB	Configuration Control Board
DAAC	Distributed Active Archive Center
DARPA	Defense Advanced Research Projects Agency
DCN	Document Change Notice
DSU	Data Service Unit
EBnet	EOSDIS Backbone Network
ECS	EOSDIS Core System
EDOS	EOS Data and Operations System
EGS	EOS Ground Systems
EMC	Enterprise Management Concept Team
EOS	Earth Observing System
EOSDIS	Earth Observing System Data and Information System
ESDIS	Earth Science Data Information Systems
GSFC	Goddard Space Flight Center
HPOV	HPOpenView
ICD	Interface Control Document
IP	Internet Protocol
IRD	Interface Requirements Document
LSM	Local System Manager
LRU	Line Replaceable Unit
MIB	Management Information Base
MO&DSD	Mission Operations and Data Systems Directorate
MTTRS	Mean Time To Restore Service
NASA	National Aeronautics and Space Administration
Nascom	NASA Communications
NOC	Network Operations Center
NOLAN	Nascom Operational LAN

PSCN	Program Support Communications Network
RFC	Request For Comment
SAS	Statistical Analysis System
SLA	Service Level Agreement
SMC	Systems Management Center
SMTP	Simple Mail Transfer Protocol
SNMP	Simple Network Management Protocol
WAN	Wide Area Network
WWW	World Wide Web

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